

**WHAT IS CLAIMED IS:**

1           1. A clutch controller of a mechanical automatic  
2     transmission which enables automatic transmission  
3     operation by means of providing a transmission gear  
4     mechanism with an actuator and a clutch mechanism  
5     with an actuator, the controller comprising:  
6           engine speed detection means for detecting an  
7     engine speed;  
8           accelerator position detection means for  
9     detecting the position of an accelerator;  
10          range setting means for setting an engine speed  
11     range in which engine output torque falls within a  
12     predetermined range including a maximum value at the  
13     position of said accelerator detected by said  
14     accelerator position detection means; and  
15          control means which effects direct engagement  
16     of a clutch when a vehicle is pulled away while  
17     controlling a connected state of said clutch such that  
18     the engine speed detected by said engine speed  
19     detection means falls within said engine speed range  
20     set by said range setting means.

1           2. The clutch controller of the mechanical  
2     automatic transmission according to claim 1, wherein  
3     said range setting means sets a first threshold value  
4     at an engine speed lower than an engine speed at which

5     said engine output torque becomes maximum at said  
6     position of said accelerator and sets a second  
7     threshold value at an engine speed higher than said  
8     engine speed, thereby setting said engine speed range.

1             3. The clutch controller of the mechanical  
2     automatic transmission according to claim 2, wherein  
3     said first threshold value and said second threshold  
4     value are set in accordance with said position of said  
5     accelerator.

1             4. The clutch controller of the mechanical  
2     automatic transmission according to claim 2, wherein  
3     said control means comprises  
4             a storage section for storing a map in which  
5     clutch stroke speeds corresponding to a rate of change  
6     in said engine speed are set with regard to three  
7     ranges; namely, a first range which is lower in engine  
8     speed than said first threshold value, a second range  
9     falling between said first threshold value and said  
10    second threshold value, and a third range higher in  
11    engine speed than said second threshold value;  
12             a determination section for determining which  
13    one of said three ranges that said engine speed detected  
14    by said engine speed detection means falls within;  
15    and  
16             a clutch control section which selects from said

17 map a clutch stroke speed corresponding to the range  
18 determined by said determination section and controls  
19 said clutch stroke speed of said clutch.

1 5. The clutch controller of the mechanical  
2 automatic transmission defined in claim 4, wherein  
3 said storage section stores, as said map, control lines  
4 corresponding to said three ranges on coordinates  
5 formed from the rate of change in said engine speed  
6 and said clutch stroke speed;

7 said control line of the second range is set so  
8 as to increase said clutch stroke speed in a clutch  
9 engagement direction when the rate of change in said  
10 engine speed has increased and to increase said clutch  
11 stroke speed in a clutch disengagement direction when  
12 the rate of said engine speed has decreased; and

13 said control line of said first range is a line  
14 obtained as a result of said control line in said second  
15 range having been shifted toward an increase in the  
16 rate of change in said engine speed, and said control  
17 line of said third range is a line obtained as a result  
18 of said control line of said second range having been  
19 shifted toward a decrease in the rate of change in  
20 said engine speed.

1 6. The clutch controller of the mechanical  
2 automatic transmission defined in claim 4, wherein

3           said storage section stores a map in which are  
4   set clutch stroke speeds corresponding to the rate  
5   of change in said engine speed in connection with a  
6   plurality of ranges into which said first range has  
7   been divided;

8           said determination section determines which one  
9   of said plurality of ranges within said first range  
10   includes said engine speed detected by said engine  
11   speed detection means when said detected engine speed  
12   falls within said first range; and

13          said clutch control section controls said clutch  
14   stroke speed of said clutch by means of selecting,  
15   from said map, a clutch stroke speed corresponding  
16   to said range determined by said determination  
17   section.

1           7. The clutch controller of the mechanical  
2   automatic transmission defined in claim 6, wherein  
3   said storage section stores, as said map, sub-control  
4   lines corresponding to said plurality of ranges within  
5   said first range on coordinates formed from the rate  
6   of change in engine speed and said clutch stroke speed;  
7   and

8           said sub-control lines assigned to said  
9   plurality of ranges within said first range are formed  
10   by shifting at intervals said control line of said  
11   second range toward an increase in the rate of said

12 engine speed.

1 8. The clutch controller of the mechanical  
2 automatic transmission defined in claim 4, wherein  
3 said storage section stores a map in which are  
4 set clutch stroke speeds corresponding to the rate  
5 of change in said engine speed in connection with a  
6 plurality of ranges into which said third range has  
7 been divided;

8 said determination section determines which one  
9 of said plurality of ranges within said third range  
10 includes said engine speed detected by said engine  
11 speed detection means when said detected engine speed  
12 falls within said third range; and

13 said clutch control section controls said clutch  
14 stroke speed of said clutch by means of selecting,  
15 from said map, a clutch stroke speed corresponding  
16 to said range determined by said determination  
17 section.

1 9. The clutch controller of the mechanical  
2 automatic transmission defined in claim 6, wherein  
3 said storage section stores a map in which are  
4 set clutch stroke speeds corresponding to the rate  
5 of change in said engine speed in connection with a  
6 plurality of ranges into which said third range has  
7 been divided;

8           said determination section determines which one  
9   of said plurality of ranges within said third range  
10   includes said engine speed detected by said engine  
11   speed detection means when said detected engine speed  
12   falls within said third range; and

13           said clutch control section controls said clutch  
14   stroke speed of said clutch by means of selecting,  
15   from said map, a clutch stroke speed corresponding  
16   to said range determined by said determination  
17   section.

1           10. The clutch controller of the mechanical  
2   automatic transmission defined in claim 8, wherein  
3   said storage section stores, as said map, sub-control  
4   lines corresponding to said plurality of ranges within  
5   said third range on coordinates formed from the rate  
6   of change in engine speed and said clutch stroke speed;  
7   and

8           said sub-control lines assigned to said  
9   plurality of ranges within said third range are formed  
10   by shifting at intervals said control line of said  
11   second range toward a decrease in the rate of said  
12   engine speed.

1           11. The clutch controller of the mechanical  
2   automatic transmission defined in claim 9, wherein  
3   said storage section stores, as said map, sub-control

4 lines corresponding to said plurality of ranges within  
5 said third range on coordinates formed from the rate  
6 of change in engine speed and said clutch stroke speed;  
7 and  
8 said sub-control lines assigned to said  
9 plurality of ranges within said third range are formed  
10 by shifting at intervals said control line of said  
11 second range toward a decrease in the rate of said  
12 engine speed.

1 12. A method for controlling a clutch of a  
2 mechanical automatic transmission which enables  
3 automatic transmission operation by means of  
4 providing a transmission gear mechanism with an  
5 actuator and a clutch mechanism with an actuator, the  
6 method comprising the steps of:  
7 detecting an engine speed and the position of  
8 an accelerator;  
9 setting a first threshold value at an engine speed  
10 lower than an engine speed at which said engine output  
11 torque becomes maximum at said detected position of  
12 said accelerator and setting a second threshold value  
13 at an engine speed higher than said engine speed; and  
14 effecting direct engagement of said clutch while  
15 controlling a connected state of said clutch such that  
16 said detected engine speed falls between said set first  
17 threshold value and said second threshold value.

1           13. The method for controlling a clutch of a  
2 mechanical automatic transmission according to claim  
3 12, wherein, when said detected engine speed is lower  
4 than said first threshold value, said clutch is  
5 controlled so as to be disengaged; and, when said  
6 detected engine speed is higher than said second  
7 threshold value, said clutch is controlled so as to  
8 be engaged.

1           14. The method for controlling a clutch of a  
2 mechanical automatic transmission according to claim  
3 12, wherein a low engine speed sub-threshold value  
4 is set at an engine speed which is lower than said  
5 first threshold value; and, when said detected engine  
6 speed is lower than said engine speed sub-threshold  
7 value, a clutch stroke speed is increased toward said  
8 clutch disengagement direction as compared with a case  
9 where said detected engine speed falls between said  
10 first threshold value and said low engine speed  
11 sub-threshold value.

1           15. The method for controlling a clutch of a  
2 mechanical automatic transmission according to claim  
3 14, wherein a plurality of said low engine speed  
4 sub-threshold values are set at engine speeds lower  
5 than said first threshold value; and, when said



6 detected engine speed falls between an  $(n+1)^{th}$  ( $n$ ;  
7 natural number) low engine speed sub-threshold value  
8 and an  $(n+2)^{th}$  low engine speed sub-threshold value  
9 toward a lower engine speed from said first threshold  
10 value, said clutch stroke speed is increased toward  
11 said clutch disengagement direction as compared with  
12 a case where said detected engine speed falls between  
13 an  $n^{th}$  low engine speed sub-threshold value and said  
14  $(n+1)^{th}$  low engine speed sub-threshold value.

1 16. The method for controlling a clutch of a  
2 mechanical automatic transmission according to claim  
3 12, wherein a high engine speed sub-threshold value  
4 is set at an engine speed higher than said second  
5 threshold value; and, when said detected engine speed  
6 is higher than said high engine speed sub-threshold  
7 value, said clutch stroke speed is increased toward  
8 said clutch engagement direction as compared with a  
9 case where said detected engine speed falls between  
10 said first threshold value and said high engine speed  
11 sub-threshold value.

1 17. The method for controlling a clutch of a  
2 mechanical automatic transmission according to claim  
3 14, wherein a high engine speed sub-threshold value  
4 is set at an engine speed higher than said second  
5 threshold value; and, when said detected engine speed

6 is higher than said high engine speed sub-threshold  
7 value, said clutch stroke speed is increased toward  
8 said clutch engagement direction as compared with a  
9 case where said detected engine speed falls between  
10 said first threshold value and said high engine speed  
11 sub-threshold value.

1 18. The method for controlling a clutch of a  
2 mechanical automatic transmission according to claim  
3 16, wherein a plurality of said high engine speed  
4 sub-threshold values are set at engine speeds higher  
5 than said first threshold value; and, when said  
6 detected engine speed falls between an  $(n+1)^{\text{th}}$  ( $n$ ;  
7 natural number) high engine speed sub-threshold value  
8 and an  $(n+2)^{\text{th}}$  high engine speed sub-threshold value  
9 toward a higher engine speed from said first threshold  
10 value, said clutch stroke speed is increased toward  
11 said clutch engagement direction as compared with a  
12 case where said detected engine speed falls between  
13 an  $n^{\text{th}}$  high engine speed sub-threshold value and said  
14  $(n+1)^{\text{th}}$  high engine speed sub-threshold value.

1 19. The method for controlling a clutch of a  
2 mechanical automatic transmission according to claim  
3 17, wherein a plurality of said high engine speed  
4 sub-threshold values are set at engine speeds higher  
5 than said first threshold value; and, when said

6 detected engine speed falls between an  $(n+1)^{\text{th}}$  ( $n$ ;  
7 natural number) high engine speed sub-threshold value  
8 and an  $(n+2)^{\text{th}}$  high engine speed sub-threshold value  
9 toward a higher engine speed from said first threshold  
10 value, said clutch stroke speed is increased toward  
11 said clutch engagement direction as compared with a  
12 case where said detected engine speed falls between  
13 an  $n^{\text{th}}$  high engine speed sub-threshold value and said  
14  $(n+1)^{\text{th}}$  high engine speed sub-threshold value.  
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